REMARKS

Claims 8-25 are presently in the application.

Reconsideration of the rejection of claims 8-19 under 35 USC 112, second paragraph, as indefinite is respectfully requested. On page 2 of the Office action, the examiner has misidentified claims 8 and 9 as claims 9 and 10, respectively. Thus, on page 2, the references to "claim 9" are understood as references to claim 8 and, on pages 2 and 3, the references to "claim 10" are understood as references to claim 9. The examiner objected to the "in particular . . . " language of claim 8 and found a lack of antecedent basis for the expressions "the tightening direction" and "the release direction." Claim 8 has been amended to delete the "in particular . . . " language and to provide proper antecedent basis for the tightening and the release directions. The meaning of tightening direction and release direction is found in the specification. See, for example, page 1, line 19 and page 2, line 1. Claims 11, 13, 15 and 17 have been amended to properly refer to repeating steps (a) and (b), rather than to steps (b) and (c).

The examiner also determined that the language "a quasi-static terminal braking state" and "if at all, only imperceptibly" in claim 8 and the language "a quasi-steady state" and "if at all, only imperceptibly" in claim 9 is indefinite.

The second paragraph of 35 USC 112 requires claims to set out and circumscribe a particular area with a <u>reasonable</u> degree of precision and particularity. <u>In re Johnson</u>, 558 F.2d 19008, 1015, 194 USPQ 187, 193 (CCPA 1977). The language "a quasi-static terminal braking state" is clearly defined in applicant's specification as that state at which a torque of the electric motor, at maximum current

supply, no longer suffices to further increase the contact pressure of the friction brake lining against the brake body. See page 2, line 9-11 and page 8, lines 17-20. As such, the language "quasi-static terminal braking state" (claim 8) and "quasi-static state" (claim 9, as amended) is not indefinite.

In addition, claims 8 and 9 have been amended to recite that any reduction of the force or braking force exerted is imperceptible. What is meant by the expression in claims 8 and 9 that the braking force is reduced imperceptibly is that the wheel brake assembly is actuated in the release direction only so briefly that any stresses in the drive of the wheel brake assembly will be reversed and the static friction will change into a sliding friction. See page 5, line 14-17.

In view of the above, claims 8-19 are in full compliance with the requirements of the second paragraph of 35 USC 112.

Reconsideration of the rejection of claims 8, 10, 12, 14, 16 and 18 under 102(a) as anticipated by Schenk et al (US 5,090,518) is also respectfully requested. In electromechanical wheel brake assemblies of the prior art, an electric motor is supplied with current in the tightening direction, until a desired braking force is reached. However, the braking force of prior art electromechanical wheel brake assemblies can only be increased until such time as a quasi-static terminal state is reached, at which point the torque of the electric motor, at maximum current supply, no longer suffices to further increase the contact pressure of the friction brake lining against the brake body. Applicant has discovered that by performing applicant's claimed method, the braking force of the wheel brake assembly can be increased by approximately one-third compared to the value in the quasi-static terminal state. That is, according to

applicant's method, the braking force is further increased even after the quasi-static terminal state has been reached by actuating the wheel brake assembly for a brief period of time in the release direction and then again tightened. It is believed that by actuating the wheel brake assembly for a brief period of time in the release direction, the static friction in the wheel brake assembly is overcome, and the moving parts of the wheel brake assembly are once again put into motion. After being released, the wheel brake assembly is again tightened, and the subsequent braking force attained is greater than the braking force attained in the quasi-static terminal state, because the static friction in the wheel brake assembly need not be overcome.

Schenk et al discloses (Fig. 1) a brake system using a pair of brake units (24 and 26) each unit having an electric motor (28 or 38) with non-backdriveable mechanical output members (30 or 32) and piezoelectric elements (36 or 46) that generate high forces with low expansion during rapid rates of change of applied voltage and are positioned in brake apply force-transmitting series with the motor output members (30 or 32). The piezoelectric elements are alternately energized with applied voltage and deenergized, in opposite phase relation. The piezoelectric expansion effect of each energized element is mechanically captured in each energization cycle by the motor unit having the deenergized element so that the brake apply forces actually applied to actuate the brake are increased beyond the maximum output of the motors. This is obtained by the alternating energization of the piezoelectric elements and the alternating follow-up actions of the motors, with the non-backdrivable arrangements acting to store the mechanical force increases so attained.

To support a rejection of a claim under 35 U.S.C. § 102(b), it must be shown that each element of the claim is found, either expressly described or under principles of inherency, in a single prior art reference. See Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 772, 218 USPQ 781, 789 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026 (1984).

The examiner describes Schenk as disclosing a method for actuating a wheel brake assembly comprising the steps of (a) initially actuating the brake assembly in the tightening direction, (b) then actuating the wheel brake assembly for a brief period of time in the release direction, and (c) then again actuating the brake assembly in the tightening direction, said brief period of time being selected to be "so short that the braking force is reduced" (it is assumed the examiner meant to say --so short that the braking force is not reduced).

With regard to the wheel control system illustrated in Fig. 4, Schenk does disclose that crystals 136 and 146 can be cyclically energized and de-energized (see column 9, lines 35-39), but there is no teaching in Schenk that the period of time the crystals are de-energized is selected to be so short that any reduction of the braking force is imperceptible, as required by claims 8 and 9.

More particularly, Schenk uses two parallel-connected actuating units, each having a primary actuator (electric motors 28 or 38), a self-locking gear 30 or 40 for converting a rotary motion of the motor drive to a longitudinal motion, and a secondary actuator (piezoelectric actuators 36 or 46). Thus, Schenk uses a total of four actuators to apply a braking force, of which the two piezoelectric actuators 36, 46 are alternately actuated, that is, when power is supplied to piezoelectric actuator 36, power is removed

from piezoelectric actuators 46, and vice versa. See col. 5, ll. 14, 15. In addition, in the actuating unit having whichever piezoelectric actuator that is not supplied with power, the associated primary actuator (electric motor 28 or 38) must be supplied with power to drive the motor in the brake force applying direction, that is, in the tightening direction. Once the associated primary actuator reaches its maximum force output its associated piezoelectric actuator is supplied with power while power is removed from the other piezoelectric actuator. This braking operation is graphically illustrated in Fig. 2 of Schenk. At no time during the actuation of Schenk's brake system is it taught that the brake device is released to overcome the static friction existing in the brake system.

Further, nowhere in Schenk's description of the embodiment illustrated in Fig. 1 is there any teaching or suggestion of a method for actuating a mechanical system, such as, a wheel brake assembly, involving friction and having a spring elasticity to increase a force exerted by the system beyond a force attainable in a quasi-static state comprising the steps of actuating the system for a brief period of time in a release direction and then actuating the system in a tightening direction, the period of time of the actuation in the release direction being selected to be so short that any reduction of the force exerted is imperceptible. To the contrary, Schenk et al teaches the electric motors (28 and 38) are always actuated in the tightening direction during the brake applying phrase of operation (see Fig. 2). As a result, even when the piezoelectric element of a particular brake unit is deenergized, the brake unit (24 or 26), as a whole, is still actuated in the tightening direction.

Schenk et al also discloses (Fig. 4) a second embodiment including a wheel lock control. When actuated, this feature sets the output force generated by the motors,

deenergizes the piezoelectric elements, and then concurrently energizes and deenergizes them to obtain a brake pumping action while preventing excessive wheel slip. Once again, Schenk et al teaches only that the piezoelectric elements are deenergized. There is no teaching of any actuation of the brake units in both directions during the brake applying phrase of operation or that Schenk is seeking a brief release of the brake device to overcome the static friction existing in the brake system.

In view of the above, Schenk et al does not anticipate claims 8 and 9 or claims 10-19 dependent on claim 8 or claim 9.

New independent claim 20 is even more specific than claim 8 or claim 9 and specifically recites a method for actuating an electromechanical wheel brake assembly having an electric motor, a brake actuator and means connecting the electric motor to the brake actuator for converting rotary motion of the electric motor into a translational motion. As explained in the specification, the method of the invention can be employed in existing electromechanical wheel brake assemblies (page 3, lines 1 -2) in which the connecting means may be a conversion gear, typically a spindle drive (page 1, line 18), a cam (page 2, line 3) or a nut of the spindle drive of the electric motor (page 2, line 3-4). The brake actuator may be a friction brake lining (page 1, line 19). The method comprising the steps of (a) initially actuating the electric motor in a tightening direction to cause the brake actuator to be pressed against a brake body to establish a quasi-static terminal braking state, then (b) actuating the electric motor for a brief period of time in a release direction opposite to the tightening direction, and then (c) again actuating the electric motor in the tightening direction, said brief period of time of the

actuation in the release direction being selected to be so short that any reduction of the braking force is imperceptible.

No where in Schenk's description of the embodiments illustrated in Figs. 1 and 4 is there any teaching or suggestion of a method for actuating an electromechanical braking system comprising the steps of (a) initially actuating the electric motor in a tightening direction to cause the brake actuator to be pressed against a brake body to establish a quasi-static terminal braking state, then (b) actuating the electric motor for a brief period of time in a release direction opposite to the tightening direction, and then (c) again actuating the electric motor in the tightening direction, said brief period of time of the actuation in the release direction being selected to be so short that any reduction of the braking force is imperceptible. To the contrary, Schenk et al teaches the electric motors (28 and 38) are always actuated in the tightening direction during the brake applying phrase of operation (see Fig. 2). As a result, even when the piezoelectric element of a particular brake unit is deenergized, the brake unit (24 or 26), as a whole, is still actuated in the tightening direction. Also, with respect to Fig. 4, Schenk et al teaches only that the piezoelectric elements are deenergized. There is no teaching of any actuation of the electric motors in both directions during the brake applying phrase of operation or that Schenk is seeking a brief release of the brake device to overcome the static friction existing in the brake system.

In view of the above, Schenk et al does not anticipate or render obvious claim 20 or claims 21-25 dependent on claim 20.

In accordance with the foregoing, applicant respectfully requests that the examiner reconsider and withdraw the outstanding rejections. If, however, the examiner feels that any further issues remain or require clarification, the examiner is cordially invited to contact the undersigned in order that any such issues may be promptly resolved.

Respectfully submitted,

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